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Labview Based Hand Gesture Recognition for Deaf and Dumb People

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Abstract : *To Interact With Each Other Communication Plays A Vital Role In Human Life. Differently Able People Especially Deaf And Dumb Persons Cannot Communicate With The Normal People. Sign Language (Special Gestures) Is Used By Deaf And Dumb People To Communicate. Different Methods Are In Use For Recognizing Sign (Gesture Movement) And Converting Into Text And Voice Formats. In This Paper, A Review Is Done About Existing Techniques. Lab View Based Gesture Recognition System Is Developed To Identify The Hand Gesture Which Can Help Deaf And Dumb People To Interact With Computer And Others More Easily.*
Keywords *- Hand Gesture, Lab View, Sign Language ,Virtual Instrumentation,.*

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I. INTRODUCTION

Deaf And Dumb People Cannot Communicate With Normal People Because Of Communication Barrier Between Them. As Per Census 2011, At All India Level, Disabled Persons Constitute 2.21% Of The Total Population. In India Around 19% Of Disabled Persons Are Having Disability In Hearing And 7% In Speech Recognition [9]. Gestures Are Expressive, Meaningful Body Motions For Communication. Disabled People Use Different Forms Of Hand Shapes And Movements To Convey The Message. Gesture Recognition Is The Mathematical Interpretation Of A Human Motion By Computing Devices. Hand Gesture Recognition Is A Method In Which Gestures Produced By The User Are Decoded By The System. This System Helps The Dumb And Deaf People To Input Their Data Using Hand Gestures And The Input Data Is Converted Into The Respective Alphabet And Voice.[2] Hand Gesture Recognition System Provides A Feasible Solution To Control Various Domestic, Industrial And Biomedical Applications. Recently, There Has Been A Significant Increase In The Development Of Assistive Technology For People With Disabilities Leading To Improvement In The Traditional Systems. Also, The Growing Use Of The Computer In Work And Leisure Has Led To The Development Of Pc-Associated Handling Applications, Mainly Using Graphic Interfaces.[3]The Increased Performance Of Personal Computers And Their Reduced Cost Has Made Pc Based Systems Achievable. A Technology Is Required Which Convert Sign Language Into Respective Alphabet And Voices So The Deaf And Dumb People Can Communicate With Normal People

II. LITERATURE REVIEW

Hand Gesture Recognition System Can Be Modified For Disabled People. For Any System The First Step Is To Collect The Data Necessary To Accomplish A Specific Task. For Hand Posture And Gesture Recognition System Different Technologies Are Used For Acquiring Input Data. Present Technologies For Recognizing Gestures Can Be Divided Into Vision Based, Instrumented Data Glove And Colored Marker Approaches. [4]Data Glove Devices And Color Markers Needs Additional Hardware Devices To Easily Extract Comprehensive Description Of Gesture Features [5].

2.1 Vision Based Approaches

Camera Is Required To Capture The Image In Vision Based Approach Which Can Be Use For Nature Interaction Of Human And Computers Without Any Need Of Extra Supporting Hardware. There Are Many Techniques Used For Detecting Hand Object After Some Image Preprocessing Operations, These Methods Can Be Divided Into Two Part As Appearance Based Approaches And 3D Model Based Approaches [13]

2.2. Instrumented Glove Approaches

Data Glove Approaches Use Sensor Devices For Capturing Hand Position And Motion. In This Approach, Sensors Can Easily Extract Coordinates Of Palm, Finger's Location And Orientation Along With Hand Configurations. However, These Approaches Require The User Need To Be Connected With The

Computer Physically. The Prices Of These Devices Are Quite Expensive And It Is Inefficient For Working In Virtual Reality. [13][14]

2.3. Colored Markers Approaches

In This Approach Marked Gloves Or Colored Markers Gloves Are Worn By The Human Hand With Some Colors To Direct The Process Of Tracking The Hand And Locating The Palm And Fingers. With The Help Of This Geometric Features Can Be Extracted Which From The Hand Shape. This Technology Is Simple In Use And Cost Is Low Compare To Instrumented Data Glove. However, This Technology Still Limits The Naturalness Level For Human Computer Interaction To Interact With The Computer.[15]

III. Hand Gesture Recognition

Most Of The Researchers Classified Gesture Recognition System Into Mainly Three Steps After Acquiring The Input Image From Camera(S), Videos Or Even Data Glove Instrumented Device. These Steps Are Image Preprocessing, Features Estimation And Extraction And Classification Or Recognition As Illustrated In Figure 3.1

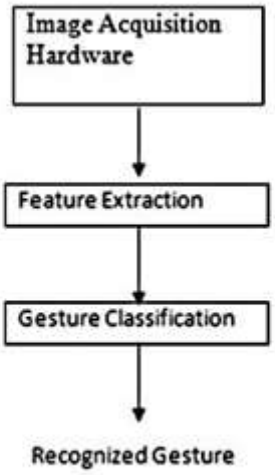

Fig.3.1 Flow diagram for gesture recognition

First Step For Recognition Of Hand Gesture Is Segmentation Process. It Is The Process Of Dividing The Input Image (Hand Gesture Image) Into Regions Separated By Boundaries. Gestures Can Be Static Or Dynamic Type. Static Means Fixed Pose Or Posture Which Needs Less Computational Complexity As Compared To Dynamic, Whereas Dynamic Is More Suitable For Real Time Applications.[12] Generally, Edge (Bounding Box) Is Used To Specify Depending On Gesture. Different Tools And Methods Used Skin And Non-Skin Pixels To Model The Hand. These Methods Are Parametric And Non-Parametric Techniques, Gaussian Model (GM) And Gaussian Mixture Model (GMM) Are Parametric Techniques And Histogram Based Techniques Are Non- Parametric. Data Glove And Colored Markers Methods Are Used To Provide Exact Information About The Orientation And Position Of Palm And Fingers. [7] However, There Are Some Factors That Obstacle The Segmentation Process Which Is Complex Background, Illumination Changes, Low Video Quality.

3.2 Feature Extraction

Good Segmentation Process Leads To Perfect Features Extraction Process And The Latter Play An Important Role In A Successful Recognition Process. Feature Extraction Is A Method Of Reducing Data Dimensionality By Encoding Related Information In A Compressed Representation And Removing Less Discriminative Data. Feature Extraction Plays Vital Role To Gesture Recognition Performance. Therefore, The Selection Of Features To Deal With And Extraction Methods Used Affects More. Features Vector Of The Segmented Image Can Be Extracted In Different Ways According To Particular Application. Various Methods Have Been Applied For Representing The Features Can Be Extracted.

3.3 Feature Classification

After Modeling And Analysis Of The Input Hand Image, Gesture Classification Method Is Used To Recognize The Gesture. Recognition Process Affected With The Proper Selection Of Features Parameters And Suitable Classification Algorithm. To Classify The Gestures Different Methods Are Used Such As Euclidean. Other Soft Computing Tools Are Effective In This Field As Well, Such As Fuzzy C- Means Clustering (FCM) And Genetic Algorithms Gas. Distance, Finite State Machine, Learning Vector Quantization, Principal Component Analysis And Neural Network. Statistical Tools Used For Gesture Classification, Dynamic Gestures Have Been Identified With HMM Tool [8].

IV. ALGORITHM DESCRIPTION

The Process Of Gesture Recognition Is Mainly Divided Into Three Subsequent Parts. The First Step Is To Generate A Database Of Gestures Which Are To Be Interpreted Using Digital Camera Figure 4.1. The Images In The Databases Will Be Stored Using Jpeg Format. Standard Database Is Created By Capturing The Hand Gestures With Black Background. These Images Will Be Then Pre-Processed Using A Noise Removal Method Which Is Canny Edge Detection. These Pre-Processed Images Will Be Then Used To Obtain Feature Vectors (Mean Value) Of Each Database Image.These Image Will Be Compared With The Database Images Based On Feature Selected As Shown In Figure 4.2. The Closest Match Will Be Selected And The Corresponding Alphabet/Number Gesture Will Be Displayed On The Screen. Simultaneously Voice Output Will Also Be Played For The Respective Image.

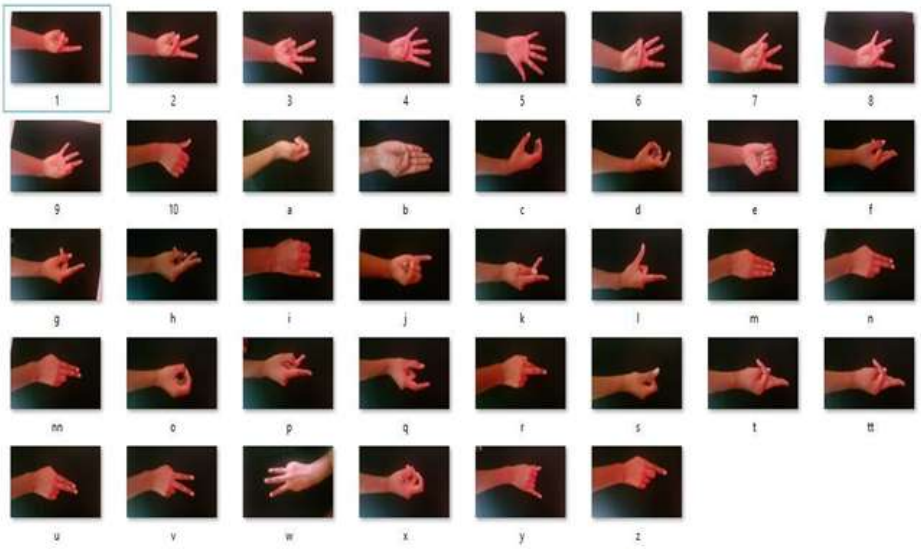

Fig.4.1 Database For Hand Gesture Recognition(Sign Language)

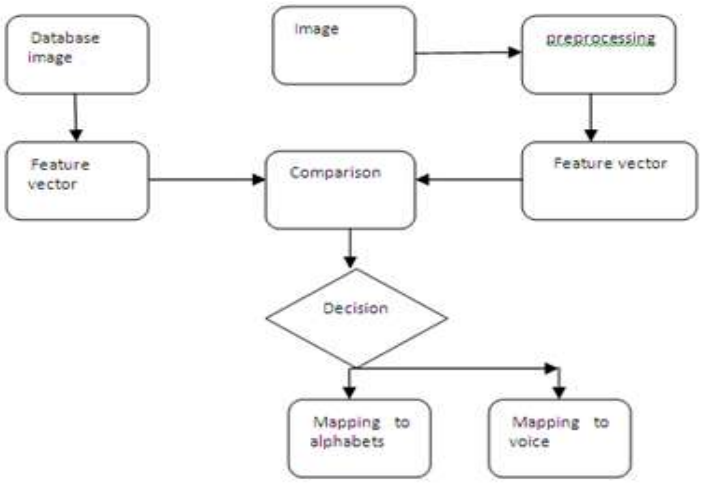

Fig.4.2 Algorithm For Gesture Recognition

V. Implementation Using Labview

Ni Labview Is A Professional Development Environment For Graphical Programming In A So-Called 'G' Language. This Software Is Being Used Worldwide For Creating Hardware Testing Applications And For A Precise Control Of Dataflow When It Is Crucial. It Is Also Popular In Real-Time Operating Systems. Since The Basic Tools Provided By The Environment Might Not Be Enough In A Professional Use, Ni Labview Brings Also A Set Of Additional Libraries For Advanced Computations. For Machine Vision And Scientific Imaging Applications, The National Instruments Corporation Has Developed An Imaq Vision Library (Also Referred As Drivers For A Hardware), Which Is A Part Of The Vision Development Module. To Facilitate Images Processing, The Ni Image Acquisition Software And The Mentioned Drivers Were Used. In Labview A User Interface Is Built With A Set Of Tools And Object. The User Interface Is Known As The Front Panel. The Code Is Use For Graphical Representation Of Functions To Control The Front Panel Objects. The Block Diagram Contains This Code. Block Diagram Resembles The Flowchart. The Labview Program Are Called Virtual Instruments Or Vis Because Their Appearance And Operation Imitate Physical Instruments, Such As An Oscilloscopes And Multimeter Etc.

Vi Contains The Following Three Components

I) Front Panel Is Serving As A User Interface

Ii) Block Diagram Which Contains The Graphical Source Code That Defines The Functionality Of The Vi

Iii) Icon And Connector Pane Identifies The Vi So That It Can Use The Vi In Another Vi.

A Vi Within Another Vi Is Called Sub Vi. A Sub Vi Corresponds To A Subroutine In Text Based Programming Language.

5.1 Vi For Image Acquisition

Webcam Or The Camera Is Interfaced With The Labview Software. As Shown In Figure 5.1, The Real Time Image Can Be Captured And Stored In The Path Specified In The Vi. Captured Image Is Also Displayed In The Front Panel Window In Labview Further It Is Preprocessed And Noise Is Removed.

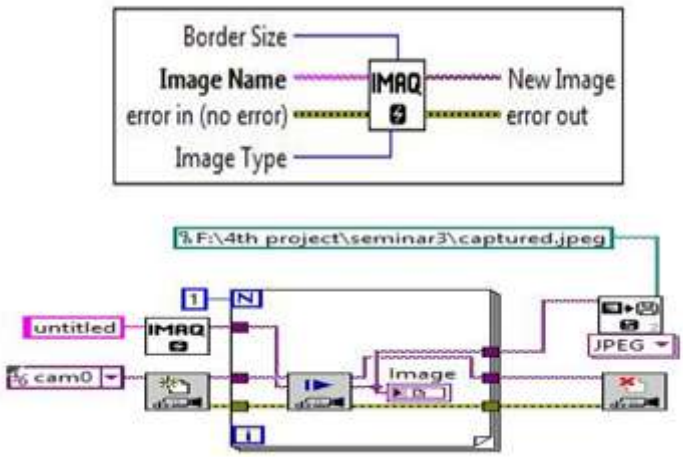

Fig.5.1 Vi For Image Acquisition

Fig .5.2 Front Panel View Of Image

5.2 Vi For Canny Edge Detection

The Captured Image Is Taken As An Input Image From The Path Specified. These Image Is Passed From The Canny Edge Detection Block With Specified Filter Parameters. According To This Parameter The Noises From The Image Is Minimized And The Image Is Converted Into Black And White Canny Edge Image Where Only Edges Of The Image Is Highlighted Which Makes The Comparison Easy .Figure 6 Shows The Image Converted To Canny Edge Image.

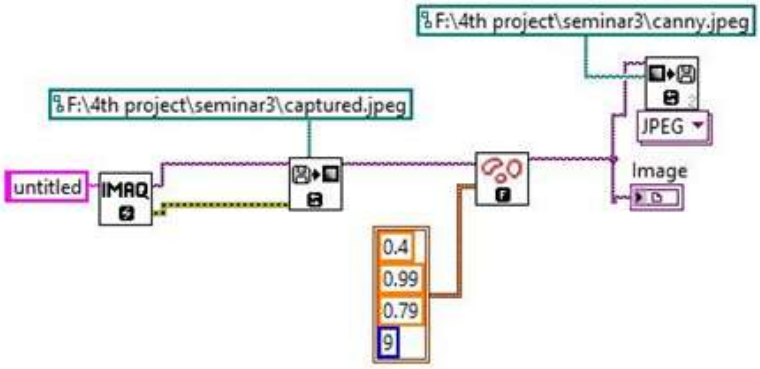

Fig 6. VI of canny edge detection

Fig.7 Front Panel View Of Canny Edge Detection

5.3 Vi For Comparison And Decision Maker

The Comparison And Decision Maker Vi Is The Main Vi Which Contains Both The Vi Described Above. Image Acquisition And Canny Edge Detection Along With The Comparison And Decision Maker Block. Firstly The Real Time Image Is Captured By The Webcam And It Is Then Passed Through Canny Edge Detection Which Converts The Image To The Canny Image With Low Noise. Now The Converted Image Is Taken By The Imaq Histogram Which Gives The Image Histogram That Can Be Seen In The Histogram Graph As Shown In The Figure 8. From The Histogram Values The Mean Value Of The Image Is Calculated. Similarly The Mean Value Of The Database Is Calculated. Here The Database Image Is Given To The Sub Tractor To Take The Difference Of Both The Image. This Difference Is Given To The In Range And Block Where The Upper Limit And Lower Limit Is Specified As 1 And 0. If The Difference Is Between 1 And 0 It Gives The True Value Otherwise The False Value. After The True Or False Value Is Decided, It Is Given To The Select Block Where The Data Is Given As An Input Which The True Or False Value Wants To Display. If The Images Are Same The True Values Display The Suitable Data And If The Images Are Not Same Then The False Value Display The Data. The Whole Vi For Comparison And Decision Maker Is Enclosed In The For Loop So That All Vi Must Run One By One And Give Appropriate Output. For Loop Runs For four Times, In

The First Loop The Webcam Capture The Image And Stored. In The Second Loop The Canny Edge Detection Reads That Image And Coverts The Image To Canny Edge Image. In The Third Loop Histogram Reads The Images In The Canny Edge Form And Calculates The Mean Values And Finally In The Fourth Loop Comparison Is Done And Decision Is Made To Display The Suitable Output. Figure 8 Shows The Vi For The Comparison And Decision Maker For The Hand Gesture Recognition System.

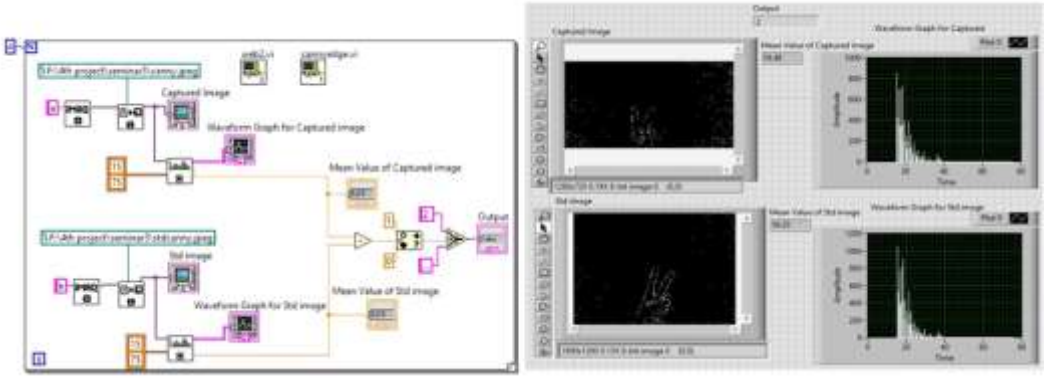

Fig 8. Hand Gesture Showing Numeric Value '2'

VI. CONCLUSION

Now Day's Different Methods Are In Use For Providing Inputs To Real Time Applications. For Disabled People Hand Gesture Based Input Is More Effective To Interact From A Distance Without Using Keyboard Or Mouse. Hand Gesture Recognition System is Developed Using Lab View Is Very Useful For The Persons Using Sign Language. It Has Been Effectively Tested For All The Alphabets And Decimal Numbers. According To Hand Movement Corresponding Alphabets And Voice Are Displayed On The Computer. This System Can Provide Assistive Service To Disabled People And There Is No Need Of Any Translator To Communicate Effectively. This Application Provides The Flexibility To The Deaf And Dumb People To Define The Gesture According To Their Feasibility And Ease Of Use.

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